

## The prevalence, characteristics and complications of mesiodens in non-syndromic pediatric patients

Evaluation of the prevalence of mesiodens

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### Abstract

**Aim:** This study aims to determine the prevalence of mesiodens in pediatric patients, and to examine the characteristics of mesiodens and the associated complications.

**Material and Methods:** Panoramic radiographs of patients aged between 5-14 years who presented to the Pediatric Dentistry Department between 2012-2019 were analyzed. Among 54895 patients, 319 were found to have 355 mesiodens. The morphology, location, eruption stage and the associated complications of mesiodens were analyzed. **Results:** The prevalence of mesiodens was found to be 0.58 %. Two hundred and twelve patients were male (66 %), 238 were in the mixed dentition stage (74.6%); 89 % of the patients (n=284) had a single mesiodens, 10.7 % had 2 and one had 3 mesiodens. Conical morphology (n=225, 63.4 %), vertical position (n=233, 65.6 %) and impaction (n=180, 50.8 %) were found to be common in mesiodens. Complications associated with mesiodens were identified as diastema (21.9 %), rotation/displacement of the adjacent tooth (14.4 %), and presence of resorption (2.6 %). 61.1 % of mesiodens were found to be asymptomatic.

**Discussion:** Although the prevalence value is similar to other studies in the literature review, it is closer to the studies on X children. Since the presence of diastema is the most common complication, radiographs should be carefully examined for the presence of mesiodens in a routine examination. Dentists need to be attentive in clinical examination to be able to prevent complications in the early stages.

### Keywords

Mesiodens, Supernumerary Tooth, Prevalence, Characteristics, Complications

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## Introduction

Supernumerary teeth are considered as a developmental anomaly that exists in addition to the regular teeth in the mouth [1]. Although their etiology is not fully known, different views have been suggested. These are the phylogenetic theory, the dichotomy theory and the hyperactivity theory. The first and the oldest is the Phylogenetic theory, which is discarded today, and it states that mesiodens is a relic of our ancestors who had three central incisors [2]. The dichotomy theory explains this as the division that occurs in the tooth bud to form two different teeth [3]. The most widely accepted theory is the hyperactivity theory, which suggests that mesiodens might emerge due to local, independent, and conditioned hyperactivity of the dental lamina that leads to the proliferation of remnants of the dental lamina [4].

Mesiodens may accompany syndromes such as cleidocranial dysplasia, Gardner syndrome, and cleft lip and palate or may be observed in non-syndromic individuals [5]. The most common type of supernumerary teeth includes teeth in the maxillary midline and are called mesiodens. They have an incidence rate of 80% among all supernumerary teeth [6].

Although it varies depending on the diagnosis methods and the differences in examined populations, studies have reported that the prevalence of mesiodens is between 0.1-1.9%. It is more common in boys than in girls [7]. Mesiodens can be seen singly in the midline or multiple unilaterally or bilaterally [3,8]. Mesiodens can show different morphological features. Conical, tuberculate, supplemental and odontoma are the commonly observed forms. The most common of these is the conical form [7, 9].

Clinical examination is not sufficient to diagnose mesiodens. Additionally, periapical, occlusal and panoramic radiographs are helpful in early diagnosis [10]. The 'same-lingual, opposite-buccal' technique is a diagnostic tool for obtaining information about the positions of the teeth [3]. On the other hand, cone-beam computed tomography (CBCT) scans reflect both the position and shape of the mesiodens and the relation of mesiodens with surrounding structures in 3D. This is important in deciding on a development of an appropriate treatment plan [1,8].

While mesiodens may be asymptomatic, they may also cause various problems [11]. Midline diastema, obstructing the eruption of permanent teeth, malformations such as root dilatation of permanent teeth, space restriction in the dental arch, or crowding are examples of these problems. On the other hand, they may cause orthodontic problems in the future. Besides, conditions that may require surgical intervention such as cyst formation and root resorption may occur [1,4,12].

Mesiodens may be asymptomatic or may cause various problems in the oral cavity. This study aims to examine the prevalence, characteristics, and associated complications of the mesiodens in the Turkish population in the Central Anatolia region, as the prevalence varies according to the population studied. We think that involving a high number of patients in the study is important in terms of understanding the prevalence of mesiodens. The null hypothesis of the study is that mesiodens may also appear in non-syndromic patients, and different prevalences can be observed in different regions within the

same population.

## Material and Methods

Ethics committee approval for the study was obtained from the Erciyes University Non-Invasive Clinical Research ethics committee (Ethics approval number: 2021/102, Date: 03.02.2021). The study was carried out by examining panoramic radiographs of 54895 pediatric patients who visited the Erciyes University Faculty of Dentistry, Department of Pedodontics between 2012-2019. Patients between the ages of 5-14 were included in the study.

### *Inclusion-exclusion criteria*

Digital panoramic radiographs (OPG X-ray machine) (71kv, 16ma, 13.4s; Instrumentarium op200D, Kavo Kerr, Germany) taken for examination and diagnosis from the patients who came for routine dental examination were included in the study. The patients were not requested to take radiographs for the study. Among the radiographs examined, those with poor image quality were excluded from the study. During anamnesis and clinical examination, patients with a history of tooth loss due to extraction or trauma were not included in the study. If the patient had multiple OPGs, only one OPG was included per patient. Syndromic cases with systemic diseases such as cleft lip/palate, Williams syndrome, Gardner syndrome, cleidocranial dysplasia, etc. were excluded from the study because of the association with the presence of supernumerary teeth. Two hundred seventeen of the 55112 OPGs examined in this context were excluded from the study.

### *Study design*

Supernumerary teeth that exist in the region between the long axes of the upper central teeth were accepted as mesiodens in this study. Panoramic radiographs of the pediatric patients were examined (C. I.), and then checked by the second researcher (K. E.). Cases in which there was a difference of opinion were re-evaluated and a consensus was reached. The assessments were made at two different times on radiographs. The initial and repeated whole assessments performed by the examiners showed that the intra- and inter-examiner agreement ranged from 0.964 to 0.981 and 0.972 to 0.990, respectively according to Cohen's Kappa ( $\kappa > 0.75$  is evaluated as a good agreement).

In addition to demographic indicators such as age and gender, patients' dentition stages (primary, mixed, and permanent dentition) were recorded. Also, the number of mesiodens and concomitant supernumerary teeth were examined. The state of the eruption of the determined mesiodens (erupted/impacted), crown shape (conical, tuberculate, supplemental, and dysmorphic), position (horizontal, vertical, and inverted), and clinical complications caused by mesiodens in patients (presence of diastema, presence of cystic structure, rotation in the adjacent tooth, and root resorption) were examined. Periapical radiographs and clinical notes were consulted if complications were suspected.

### *Statistics*

Patient data were recorded in SPSS 12 (IBM Corp; 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY, USA) for statistical analysis. The evaluations, descriptive analyses, and comparisons between the gender were made using the chi-square test.

**Results**

In the examined panoramic radiographs of the 54895 patients, 0.63% (n=319) of the patients were found to have mesiodens. The mean age of 319 patients aged 5-14 years was 8.53±2.25 years. One hundred seven of the patients were female and 212 were male. There was a statistically significant difference between gender and the presence of mesiodens (p<0.05). It is seen that 238 of the patients (74.6%) were in the mixed dentition, 26 (8.2%) were in the primary dentition and 55 (17.2%) were in the permanent dentition.

In patients with mesiodens, a total of 355 mesiodens were recorded; one in 284 patients, two in 34 patients and three in one patient (Figure 1). Seven patients had one supernumerary tooth in addition to mesiodens; one patient had additionally four supernumerary teeth (Figure 2).

The conical shape (n = 225, 63.4%) was found to be the most common group when the crown shape of 355 mesiodens was examined. The remaining ones were supplemental: 43 (12.1%), tuberculate: 71 (20%) and dysmorphic/odontoma: 16 (4.5%). The state of the eruption of mesiodens according to the crown shapes is shown in Table 1.

One hundred seventy-five of the mesiodens (49.2%) were seen in the oral cavity, and 180 (50.8%) of them were impacted. There

**Table 1.** The state of the eruption of mesiodens according to the crown shapes

Crown shape of mesiodens	Eruption of the mesiodens		Total
	Erupted	Unerupted	
Supplemental	33	10	43
Conical	110	115	225
Tuberculate	30	41	71
Dysmorphic/Odontoma	0	16	16
<b>Total</b>	<b>173</b>	<b>182</b>	<b>355</b>



**Figure 1.** Graph shows panoramic radiograph of the patient with three mesiodens



**Figure 2.** Graph shows panoramic radiograph of a patient with 4 supernumerary teeth accompanying a mesiodens

was no statistically significant difference between the eruption of the mesiodens and the presence of clinical complications (p>0.05).

In clinical complications associated with mesiodens, midline diastema in 70 patients (21.9%), rotation/ displacement of the tooth adjacent to the mesiodens in 46 patients (14.4%) and resorption in the adjacent tooth roots in eight patients (2.6%) were seen. No formation of cyst/cystic structure associated with diastema was observed. In 195 patients (61.1%), mesiodens was asymptomatic, there were no associated complications.

**Discussion**

In the study, panoramic radiographs of 54895 pediatric patients were examined, and the mesiodens prevalence, characteristics and complications associated with mesiodens were determined. The reported prevalence of mesiodens in the literature varies between 0.1 and 1.9% [7,12,13]. Previous studies have found that the prevalence of mesiodens was 1.4% (North India) according to Patil et al. [13], and 1.6% (Mexico) according to Salcido-García et al [14]. In studies conducted on Turkish patients, the rate was between 0.13 and 0.3. [7, 15, 16]. In our study conducted on patients in Turkey' s Central Anatolia, the prevalence was found to be 0.58%, which is within the range of overall prevalence rate and consistent with other studies conducted in Turkey.

The mean age of patients with mesiodens was 8.53 years and most of them were in the mixed dentition. Aren et al. found the average age in their study as [16] 9.5 years. Routine examinations of central teeth or delayed eruption or impaction of the incisor were evaluated in this age group. Therefore, the average age of the patients is within this range in most of the literature. In addition, it has been reported that mesiodens affects both teeth equally, however, it occurs more frequently in permanent teeth. The fact that the period in which the primary dentition ends and the permanent teeth begin to erupt coincides with the mean age that was found in this study is in accordance with the literature.

Studies report that the mesiodens appears more often in boys. Nonetheless, Colak et al. [7] found that, in contrary to the general findings, mesiodens was more frequent in women. Zhao et al. found that the male to female ratio was 2.9:1 [17] and 2.3:1 according to Aren et al. [16]. Similar to previous studies, the male to female ratio was 2.1:1 in our study.

Mesiodens can occur singly or multiply. According to the literature, a single mesiodens is more common, and except for non-syndromic individuals, multiple mesiodens are rare. Asaumi et al. [6] and Gündüz et al. [15] reported mostly single mesiodens in the patients. In some studies, no triple mesiodens could be found [12,13]. In addition, no studies reported more than triple mesiodens. In this study, 89% of the patients had a single mesiodens, 10.7% had two mesiodens, and 0.3% had triple mesiodens.

Mesiodens vary in shape and are generally classified as conical, tuberculate, supplemental and dysmorphic/odontoma-like [4]. In accordance with similar studies in the literature, conical-shaped mesiodens was found to be the most common in this study [16-18]. Following conical mesiodens, in terms of prevalence, Altan et al. [18] reported supplemental, tuberculate mesiodens, and

Aren et al. [16] reported tuberculate, supplemental mesiodens. In addition, in many studies, odontoma/dysmorphic mesiodens was not included in the morphological classifications [12, 16, 18, 19]. In this study, the most common shapes after conical mesiodens are supplemental, tuberculate, and odontoma-like mesiodens, respectively.

Altan et al. reported that the eruption rate was the highest in conical mesiodens, while it was the lowest in tuberculate ones in their study [18]. In this study, the eruption was 81% in supplemental mesiodens, 45% in conical mesiodens, and 26% in tuberculate mesiodens. In addition, none of the 16 dysmorphic/odontoma-shaped mesiodens were erupted. The morphology of supplementary mesiodens resembles teeth, and they usually develop roots fully, which explains why they are the most likely to erupt. The morphology of conical mesiodens, which is more likely to erupt than tuberculate mesiodens, and the failure of eruption due to arrested root formation in odontoma shape explain the findings of this study. However, more studies are needed on the relation between tooth morphology and eruption. In one study, supplemental mesiodens was found to be more common in the permanent dentition than in the primary dentition [18]. In this study, conical mesiodens was found to be more common in both dentition stages. However, the majority of the patients in this study were in the mixed dentition (74.6%), and the number of patients was not adequate to examine the primary and permanent dentitions.

Mesiodens are mostly vertical, but can also be found horizontal, semi-vertical, or inverted [15,20]. Aren et al. [16] found the rate of mesiodens in vertical position as 77.1%, Altan et al. [18] as 76.8%, and Göksel et al. as 63% [21]. Similar to these values, the rate of vertical position was found to be 66.2% in this study. 13% the mesiodens were inverted, 11.5% were horizontal and 9.3% were semi-vertical. Contrary to the findings of this study, Asaumi et al. [6] found the vertical mesiodens ratio as 27%. In addition, Roychoudhury et al. found more inverted mesiodens in their studies [22].

Complications associated with mesiodens in our study are as follows: diastema (21.9%), rotation/displacement of the adjacent tooth (14.4%), resorption in the adjacent tooth root (2.6%) and cystic structure formation. However, it was seen that 61.1% of the examined mesiodens were asymptomatic. In accordance with the findings, Altan et al. and Lee et al. found the most common complication to be diastema [18, 23]. Dinkar et al. report that there is a correlation between mesiodens and dentigerous cysts [24]. Nonetheless, while Lee et al. [23] found only 0.5% dentigerous cysts in their study, no cystic structures associated with mesiodens were observed in this study. According to a study, supplemental mesiodens cause a diastema, and conical mesiodens cause complications of displacement/rotation [19]. In this study, it is seen that supplementary teeth mostly (74.4%) cause diastema. However, since most of the examined mesiodens were conical, they were encountered the most in all complications.

While planning the treatment, mesiodens should be subjected to a thorough clinical examination and radiographic evaluation. The decision of clinical follow-up or extraction can be then made accordingly [25]. Unerupted and asymptomatic mesiodens that do not exhibit any complications may not need

surgical extraction. They can be kept under observation with regular clinical follow-up. However, if the mesiodens damage the anatomical structures in the region they are located in, adversely affect the comfort and aesthetics of the patient and prevent the treatment plan of the patient with orthodontic needs, they will need to be removed [18]. Despite the limitations of examining a patient group in a particular region, we think that involving a high number of patients in the study is important in terms of understanding the prevalence of mesiodens and its complications.

#### Limitations

The diagnosis of mesiodens with the OPG method provides limited evidence about the shape and complications of the mesiodens in terms of unclarity in the midline region. Not using 3D imaging in the study is one of the limitations of the study.

#### Conclusion

In this study in which panoramic radiographs of the non-syndromic patient population were examined, the prevalence of mesiodens was found to be similar to other studies. Since the presence of a diastema is the most common complication when detected at a routine examination, the patient should be examined for the presence of mesiodens. It was seen that the majority of the mesiodens were unerupted. This finding reveals that a thorough clinical examination and radiographic evaluation are necessary to diagnose mesiodens. Undesirable complications such as diastema, cyst formation and resorption of adjacent teeth can be eliminated with early diagnosis and timely intervention (extraction, follow-up, etc.). Dentists, pedodontists and orthodontists need to be attentive in clinical examination to be able to prevent complications and malocclusions in the early stages. We consider that it will be important to perform the study in large populations with techniques of tomography that provide better imaging in the anterior region to obtain more general results.

#### Scientific Responsibility Statement

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

#### Animal and human rights statement

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.*

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#### Conflict of interest

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